Impact of Real Effective Exchange Rates on Balance of Payments: Empirical Evidence from Nigeria

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Abstract
This paper examined the impact of the real effective exchange rate variations on the overall balance of payments in Nigeria between 1986-2019. The autoregressive distributed lag (ARDL) bounds co-integration technique was used to analyse the data based on the outcome of the stationarity test. The bounds test indicated a long-run relationship among the macroeconomic variables in the balance of payments function. Empirical evidences indicated that real exchange rate had insignificant negative effect on the balance of payments in the long-run, but exerted significant positive effect in the short-run with a lag. Private sector credit impacted negatively in the long-run, while real output significantly improved balance of payments both in the long-run and in the short-run with a lag. Lagged real interest rate and oil prices had significant positive short-run impacts, while the latter impacted negatively in the long-run. Overall, the result implied that real exchange rate depreciation may not be used to improve Nigeria's balance of payments position. The study, therefore, recommended that the monetary authority should adopt proactive export promotion policies that will strengthen and stabilise the real exchange rate of the naira. It is also important to ensure productive utilization of the private sector credits, and diversify the country away from the oil sector in view of the current global dwindling oil prices.

Keywords: Balance of payments; Real exchange rate; ADF; ARDL; Nigeria.
JEL Classification Codes: C32, E44, E52, F31, F41.

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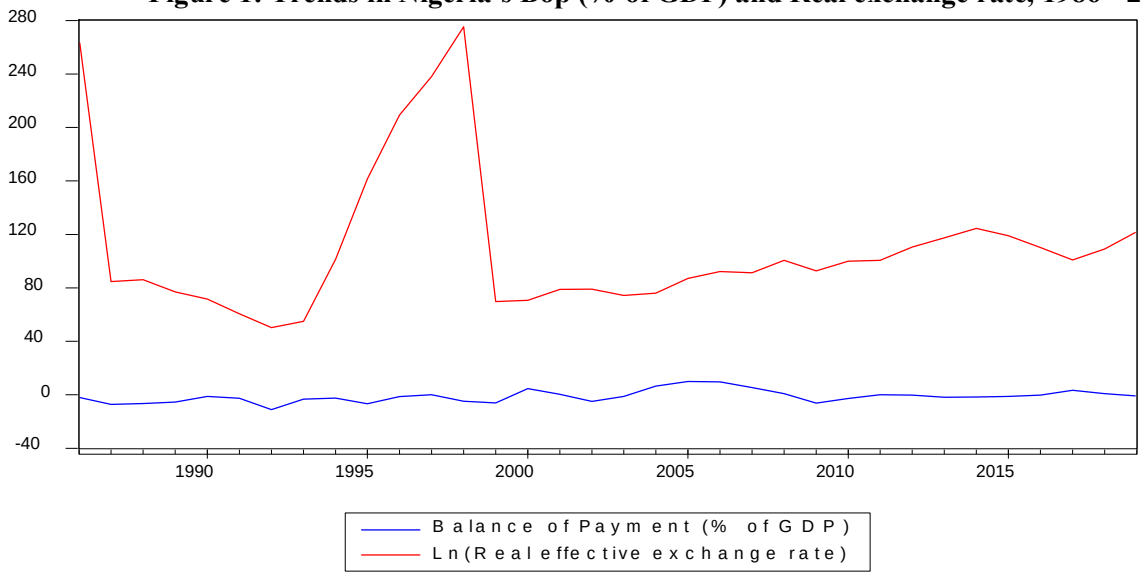
1. Introduction

One of the major challenges of macroeconomic stabilization policy in any country is how to maintain a favourable balance of payments position and at the same time safeguarding stability of the real effective exchange rate of the national currency. Achieving these twin goals is important in promoting international trade and driving the overall economic growth of a nation. Because real effective exchange rate is an essential economic indicator of economy's international competitiveness, it is expected to exert important influence on a country's exports and imports, and hence external balance. The real exchange rate can be a useful policy instrument to support the goals of structural change and export promotion, if it is well managed (Haile, 2019).

In Nigeria, the continuous weakening of the real exchange rate of the naira and the unfavourable balance of payments position have been sources of concern to many policymakers. Though it is theoretically assumed that when Nigeria's naira weakens against various trading partners' currencies, it becomes cheaper for Nigerian exporters to sell their goods and services abroad, the disequilibrium in the real effective exchange rate may cause instability in the balance of payments. A deliberate policy to depreciate the Nigerian naira began in 1986 when the federal government of Nigeria adopted the International Monetary Fund's theoretically-conceived Structural Adjustment Programme (SAP), whose one of the aims was to get the 'prices right' using the foreign exchange rate reform as its central tool (Nnanna, 2002).

Available data (CBN, 2019; WDI, 2019) shows that the Nigerian naira/US dollar bilateral exchange rate has fluctuated between 1986 to 2019. It weakened (depreciated) in twenty-four (24) years; appreciated in only six (6) years (1994, 2005 to 2008, 2013), and was stable in four years (1994 - 1998) when the naira was pegged at ₦21.8861 to a dollar. Figure 1 depicts the trends in Nigeria's balance of payments (% of GDP) and real exchange rate from 1986 -2019.

Figure 1: Trends in Nigeria's Bop (% of GDP) and Real exchange rate, 1986 - 2019



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An off-the-cuff observation shows that any fluctuation of the naira, directly or indirectly, would affect Nigeria's balance of payments position. However, one finds it difficult and inadequate to

determine a clear relationship (positive or negative) between the two variables by visually looking at the graphs. The inconclusiveness of the linkage between the two variables, therefore, calls for the need to undertake a robust econometric investigation to determine the actual relationship between these variables. Existing empirical results have generally remained inconsistent in either rejecting or supporting the conjectured positive relationship between real exchange rate and balance of payments. The controversy may arise from the sample data used, diverse analytical procedures, time horizon (short-run or long-run), and the country's status (developed or developing).

Previous studies in Nigeria have focused on the component parts of balance of payments rather than the overall balance of payments. Studies by Oladipupo and Ogbenovo (2011); Eke, Eke and Obafemi (2015); Abdullahi *et al*. (2016) focused on impact of exchange rate on capital account, while Odili (2014); Olanipekun and Ogunsola (2017), for, instance, focused on the effect of exchange rate on current account. David and Elijah (2020) expanded the scope to 2018. Also, most of the empirical studies in Nigeria, did not consider balance of payments as a proportion of the country's gross domestic output, and the effect of real effective exchange rate on the balance of payments.The studies also ignored the crucial roles of domestic credit to the private sector as a percentage share of domestic output and the dwindling oil prices in affecting Nigeria's balance of payments' position.

The current paper is different in some ways; it spanned from 1986 to 2019. Data was analysed using Pesaran *et al.* (2001)'s autoregressive distributed lag (ARDL) cointegration modeling, which researchers widely accept because of its assumed first-rate advantages over other cointegration techniques (See, Pesaran *et al*., 2001; Narayan & Smyth, 2005, etc.). The aggregate balance of payments as a percentage share of GDP was used as the dependent variable, while real effective exchange rate index was the target exogenous variable. The real effective exchange rate matters because it is the price that is relevant for import and export decisions. As observed by Cooper and John (2012), anything that would cause the real exchange rate to increase would make imports look more attractive compared to goods produced in the domestic economy The study also incorporated relevant control variables to ensure the robustness of the results.

This study is relevant in many ways. Understanding the impacts of real effective exchange rate and other included macroeconomic variables on the balance of payments is essential in analysing the sustainability of Nigeria's external balance position. The study would also provide empirical evidence to drive policy formulation in the management of real exchange rate as it impacts on Nigeria's balance of payments and provides information that could guide more studies on the subject.

Meanwhile, the paper proceeds as follows; Section 2 explicates the theoretical underpinnings and reviews the empirical literature. Section 3 describes the data, specifies the sources and discusses the econometric framework. In section 4, the empirical results are presented with several diagnostic checks, while section 5 gives the summary of findings, policy implications, and recommendations for policy and further studies.

2.1.Theoretical framework

Economic theorists have attempted to espouse the theoretical context in which exchange rate affects balance of payments using the classicists, the Keynesians, and the monetarists' perspectives. Both

the classicists and the Keynesians focus on the current account component of the balance of payments, while the monetarists concentrate on the overall balance of payments including the capital and financial accounts balances.

Leaning on the popular 'Marshall-Lerner' condition and the elasticities approach, the classical economists suggest that the exchange rate depreciation will improve the balance of payments position if the absolute sum of elasticities of demand for exports and imports is greater than one. The outcome depends on whether the exchange rate depreciation would induce substitution effects in consumption and production concerning the changes in the relative domestic and foreign prices. As noted by Sandu (2015), if the national currency follows a depreciation trend, exports are encouraged and imports diminished as far as international transactions are concerned. The elasticities approach which was built on Marshallian partial equilibrium analysis, has come under attack for ignoring cross-relations among relative goods prices and market forces, and its unrealistic assumtion that improvement in trade balance due to depreciation is matched with saving in form of accumulation of foreign exchange reserves (Meade, 1951; Dornbusch, 1971).

The Keynesians persuasion, on the other, is built on the absorption approach to the balance of payments first expounded by Alexander (1952; 1959). The theory which focuses on the production and expenditure by domestic residents on both goods and services in the economy, states that a country's balance of payments will only improve if the country's output of goods and services (Y) increase more than its absorption (expenditure by domestic residents on goods and services: Consumption + Investment + Government purchases). Once total absorption exceeds income, imports will exceed exports, resulting in a balance of payments deficit, and *vice versa*. If case of a deficit, balance of payments can be improved by either increasing income or reducing absorption (Arestis, Filho & Terra, 2018). The absorption approach holds that exchange rate and national income are positively related to balance of payments. However, the absorption approach has been faulted for concentrating on current account only, ignoring the capital and the financial accounts components of the balance of payments.

On the contrary, the monetarists assert that exchange rate affects real variables mainly through real balance effect in the short-run but leaves all real variables unchanged in the long-run (Domac, 1997). According to monetarists, surpluses in the balance of payments are caused by money demand exceeding money supply, while deficits are caused by money supply exceeding money demand. The main thesis of the monetary approach to exchange rates is that a country's exchange rate dynamics is essentially a monetary phenomenon, and that any observed disequilibrium in the balance of payments can be eliminated through an adroit manipulation of monetary variables especially domestic credit, under controlled exchange rate, absence of sterilization by the monetary authorities, and stable demand for money function (Akpansung, 1998; 2013). With faith in the purchasing power parity (PPP), the monetarists predict that in the short-run, increase in the exchange rate leads to increase in output and improves the balance of payments, Notionally, two currencies will be at purchasing power parity when a unit of domestic currency buys the similar basket of goods at home or abroad; and their relative purchasing power of the two currencies measured by the real exchange rate (Dornbusch, Fischer & Startz, 2018).

2.2. Empirical literature

There are a considerable body of literature on the relationship between exchange rates and the balance of payments in both developed and developing countries, but these empirical evidences are mixed. In the following review, the empirical evidences are grouped into two; those that reported negative impacts and those that found positive impacts.

a) **Evidences on negative impacts of exchange rate on balance of payments**

Empirical evidence based on panel ARDL model by Oshota and Badejo (2015) indicated that in the long-run, the real effective exchange rate had a negative impact on the current account balance, while GDP per capita, domestic investment, financial deepening and the dependency ratio had a positive impact on the current account balance for West African countries for the period between 1980 and 2012. In South Asia, Jayasooriya (2020) showed that in the long-run, real effective exchange rate was negatively significant while GDP growth, trade openness, and broad money were positively significant on current account balance. In the short-run, economic growth and real effective exchange rate were negatively significant.

Sanni, Musa, and Sani (2019) employed the autoregressive distributed lag (ARDL) bounds testing methodology and found a negative link between real exchange rate and current account balance in Nigeria for the period, 1960 -2016. The result implies that depreciation in the exchange rate would lead to the deterioration in the current account balance. Utilizing the same approach for the same country, Azra, Memood and Jadoon (2015) found an inverse link between real exchange rate and balance of payments both in the long-run and in the short-run in Pakistan between 1972 and 2013. In Sudan Yousif and Musa (2017) found that balance of payments and inflation, gross domestic product and exchange rate were negatively related. After employing Cochrane Orcutt method to correct for serial correlation, Oladipupo and Onotaniyahuwo (2011) found that exchange rate had significant negative impact on Nigeria's balance of payments' position between 1970 and 2008.

Iyoboyi and Muftau (2014) found that one standard deviation innovation on exchange rate reduced balance of payment in Nigeria in the medium and long terms during the period 1961-2012, whereas Olanipekun and Ogunsola (2017) indicated that exchange rate appreciation had adverse effect on Nigeria's overall balance of payments and current account balance between 1971 and 2014, while no statistically significant effect of exchange rate on capital account was obtained. Using the bound testing approach,Osisanwo, Tella, and Adesoye (2019) showed that exchange rate, domestic credit, inflation rate and gross domestic product impacted negatively on balance of payments in Nigeria within the periods, 1980-2015.Using quantile regression and Granger causality test and annual data from 1986 to 2019, Usman and Bukar (2020) found that exchange rate and openness exerted a statistically significant negative impact on Nigeria's balance of payment, while foreign direct investment had a positive impact. The study also found unidirectional causality running from exchange rate to balance of payment.

b). Evidences on positive impacts of exchange rate on balance of payments

Taking advantage of an econometric methodology that controls for simultaneity and reverse causation, Loayza, Chong and Calderon (1999) found that real exchange rate appreciation, increase in GDP, the level of public or private savings increased the current account deficit while increase in the level of world interest rates reduced the level of current account deficits in 44 developing countries during the period, 1966 -1995.

Employing both ARDL and Granger causality test, Ahmad *et al.* (2014) found a significant and positive relationship between exchange rate and balance of payments in Pakistan. In a comparative study of India and Pakistan, it was found that foreign exchange rate and inflation had positive effect, while interest rate had negative effect on the balance of payments in both countries (Shafi, Hau, Idrees & Nazeer, 2015). Taking advantage of Johansen cointegration technique on Sri'Lanka annual data spanning from 1978 to 2016, Priyatharsiny (2017) found a positive and significant long-run relationship between exchange rate and balance of payments. In a paper utilising the Generalized Autoregressive Conditional Heteroscedesticity (GARCH) technique, Oghenebrume (2018) found that exchange rate was positively related to balance of payments in Nigeria between 1980 and 2016; while real gross domestic product, inflation rate and volatility of exchange rate were negatively related to the balance of payments.The results by Abdullahi et al. (2016) revealed that exchange rate and money supply had positive effect and significantly affected Nigeria's balance of payment for the period of 1970-2014.

In a study using vector error correction modelling on Namibian data between 1991q1 to 2015q4, it was found that exchange rate affected net foreign asset (balance of payments) positively. The variable was also found to be statistically insignificant both in the long-run and short-run (Mushendami, Manuel, Shifotoka, & Nakusera, 2017). The outcome of a similar methodology in Nigeria during the period, 1986 – 2016, showed positive and significant relationship between balance of payment and exchange rate in both the short-run and the long-run (Gatawa, Elijah & Umar, 2018).The results employing ARDL methodology revealed positive and significant relationship in the long-run and a positive but insignificant relationship in the short-run between balance of payments and exchange rate in Nigeria from 1971 to 2012 (Odili, 2014) . Using a similar methodology and same case study, David and Elijah (2020) found that exchange rate and trade openness indicated positive and significant effect on balance of payments in Nigeria, while the causality result showed independent relationship between exchange rate and balance of payments for the period, 1986- 2018.

Empirical results from Gebremariam, Batu and Tola (2018) suggest that real effective exchange rates played a role in determining the short- and long-run behavior of the Ethiopian current account, which was found to improve in the long-run in response to depreciation in the real effective exchange rate. The result indicated the existence of the Marshall-Lerner condition in Ethiopia for the period 1976 to 2015.

By and large, it is apparent from the above empirical evidences that studies that have been carried out to explain the effect of exchange rate on balance of payments in both developed and developing countries have shown mixed (positive or negative) results. This indicates the matchlessness of each study; which might be attributed to the methodologies used, data measurement, sample size, etc. Existing studies in Nigeria are no exception; the conclusions have been diverse, and there has so far been no consensus in the existing literature on the subject of enquiry.

3.0. Methodology

3.1. Data descriptions, measurements and sources

The dataset for this study consisted of annual time series data for Nigeria for the period spanning, 1986 to 2019. This period marked the flexible exchange rates regime in Nigeria. The time series include values of the overall balance of payments measured as percentage of gross domestic product (BOPG); real effective exchange rate index measured as trade-weighted real effective exchange rate for the Nigerian: USD bilateral exchange rate (RER); real interest rate (RIR), measured as inflation-adjusted lending rate (in percentages); private sector credit (PSC), is net claim on the private sector by the banking system, measured as a percentage of GDP; real domestic output (RQ), measured as real gross domestic product at current basic prices in billions of naira; and crude oil price index (OLP) is a spot price of a barrel of benchmark crude, measured in US dollar per barrel.

Data on balance of payments, private domestic credit, and real output were obtained from the Central Bank of Nigeria statistical bulletin (2019), while data on crude oil prices (Bonny Light) were sourced from Organisation of Petroleum Exporting Countries (OPEC) statistical bulletins (various years). The values of real effective exchange rate and real interest rate were extracted from World Development Index database (2019).

3.2. Model specification

This study is based on the monetarists framework, which considers a country's exchange rate dynamics and the overall balance of payments essentially as monetary phenomena. The approach also focuses on the overall balance of payments including the capital and financial accounts balances. The study adopted and modified the model employed by Azra *et al*. (2015) and Gatawa, Elijah and Umar (2018) whose model for general approach to balance of payments was functionally expressed as:

$$BOP = f\,(EXR, RGDP, GEXP, MS, INF, CPS) \qquad (3.1)$$

Where; BOP denotes balance of payments, MS = Money supply, EXR = Exchange rate, RGDP = Real gross domestic product; GEXP = Government expenditures, INF = Inflation rate, CPS = Credit to private sector. The modification of the model was in line with the received literature and the current structure of Nigeria's economy. The econometric form of the functional equation was specified as:

$$BOPG = \beta_0 + \beta_1 logRER + \beta_2 logRQ + \beta_3 PSC + \beta_4 RIR + \beta_5 \log OLP + \varepsilon_t \qquad (3.2)$$

Where; all the variables retain their interpretations as indicated in section 3.1 (data descriptions, measurements and sources). Oil prices are included in the study due to the high dependency of Nigeria's economy on crude oil; it is speculated that the disequilibrium of Nigeria's overall balance of payments is largely attributed to the fluctuation in oil prices (Sakanko *et al*., 2019). Real output, private sector credit, real interest rate, and Bonny Light oil price were incorporated into the econometric model to make the empirical results more robust. As reflected in equation 3.2, real effective exchange rate index, real domestic output and crude oil price index were all log-transformed to remove possible heteroscedasticity.

Economic theory posits that the coefficients sholud have the following expected signs:

β_1: (+); β_2 : (+); β_3: (+); β_4 : (-); and β_5 (+).

In the long-run, real exchange rate (RER) index is expected to exert positive effect on balance of payments (i.e., $\beta_1 > 0$): depreciation of the domestic currency is expected to make domestic goods more desirable (cheaper) and foreign goods (denominated in foreign currency) more expensive. This should lead to a decrease in import demand and increased demand of domestic goods and services (net export), whereby it would improve the balance of payments position, ceteris paribus. Real output (RQ) is expected to have positive impact on balance of payments (i.e., $\beta_2 > 0$): increase in real output would reduce prices, and through the absorption approach, increase exports and improve balance of payments, ceteris paribus. On the other hand, private sector credit is expected to have a positive effect on balance of payments because increase in private sector credit would boost domestic investment/ production of tradable goods for exports, and ultimately improve balance of payments position, all else being equal. Increase in real interest rate (RIR) is expected to exhibit negative sign and worsen the balance of payments' position, via its negative effect on domestic investment/production, lowering exports revenue, and causing deficits in current accounts. Finally, the coefficient of the oil price is expected to be positively signed due to its direct link with balance of payments, ceteris paribus.

3.3. Analytical procedure

The study employed the autoregressive distributive lag (ARDL) methodology developed by Pesaran *et al*., (2001). The ARDL approach has more advantages over other cointegration methods (See, Pesaran *et al*., 2001; Narayan & Smyth, 2005). Under the ARDL approach, we expressed the balance of payments as being determined by its lagged value, and the current and the lag values of the explanatory variables, thus:

$$\begin{aligned}\Delta(BOPG)_t = {} & \alpha_0 + \sum_{i=1}^{j} \delta_1 \Delta(BOPG)_{t-i} + \sum_{i=0}^{\eta_1} \delta_2 \Delta LOG(RER)_{t-i} + \sum_{i=0}^{\eta_2} \delta_3 \Delta LOG(RQ)_{t-i} \\ & + \sum_{i=0}^{\eta_3} \delta_4 \Delta(PSC)_{t-i} + \sum_{i=0}^{\eta_4} \delta_5 \Delta(RIR)_{t-i} \\ & + \sum_{i=0}^{\eta_5} \delta_6 \Delta LOG(OLP)_{t-i} + \gamma_1 \mathrm{LOG}(RER)_{t-1} + \gamma_2 \mathrm{LOG}(RQ)_{t-1} + \gamma_3 (PSC)_{t-1} \\ & + \gamma_4 (RIR)_{t-1} + \gamma_5 \mathrm{LOG}(OLP)_{t-1} + \varepsilon_t \qquad (3.3)\end{aligned}$$

Where Δ indicates first-difference operator, (DBOPG); tis white noise error term, with the conventional statistical properties. j, η_1, η_2, η_3,η_4, η_5 are the optimal lag lengths to be selected either by the Akaike Information criterion (AIC) or the Schwarz Bayesian criterion (SBC), before the selected model is estimated by ordinary least squares. $\gamma_{1,2}$, γ_3,γ_4, $\gamma_5$are the long-run multipliers,

while the parameters in the summation signs ($\delta_i s$) denote the short-run of coefficients of the ARDL model.

Based on bounds testing approach to cointegration, the following hypotheses would be tested to confirm the existence or otherwise of the long-term relationship among the studied variables:

Ho: $\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5 = 0$ (no co-integration exists)

H_1:$\gamma_{1,2}, \gamma_3, \gamma_4, \gamma_5 \neq 0$ (existence of cointegration)

The null hypothesis was rejected, if the Fisherian statistic was greater than the Narayan (2004)'s upper bound critical value; the null hypothesis was accepted, if otherwise. The test was declared inconclusive, if F-statistic was between the lower and upper bound critical values. Instead of using Pesaran *et al.* (2001) bound critical values, the study applied the critical values compiled by Narayan (2004) because of the small sample size (t = 34) involved in the study. The short-run parameters were stimulated using the unrestricted error correction version of the ARDL (j, $\eta_1, \eta_{2,3}, \eta_4, \eta_5$) model concerning the variables as follows:

$$\Delta(BOPG)_t = \Gamma_0 + \sum_{i=1}^{j} \delta_1 \Delta(BOPG)_{t-i} + \sum_{i=0}^{\eta_1} \delta_2 \Delta LOG(RER)_{t-i} + \sum_{i=0}^{\eta_2} \delta_3 \Delta LOG(RQ)_{t-i} +$$

$$\sum_{i=0}^{\eta_3} \delta_4 \Delta(PSC)_{t-i} + \sum_{i=0}^{\eta_4} \delta_5 \Delta(RIR)_{t-i} + \sum_{i=0}^{\eta_5} \delta_6 \Delta LOG(OLP)_{t-i} + \Omega ECT_{t-1} + \varepsilon_t \qquad (3.4)$$

WhereΩ is the speed of adjustment, expected to be negative, less than one and significant. The lagged error correction term (ECT) gives an estimate of the time it takes for the system to revert to its original equilibrium in the advent of shock (Narayan & Narayan, 2009).

4. Results and Discussions

4.1 Descriptive statistics

Table 4.1 presenttts the summary statistics of all the variables used in this study. It shows that Nigeria's overall balance of payment (BOPG) from 1986 to 2019 recorded an average deficit of 1.20% and had experienced fluctuations reaching an all-time low (deficit) of 11.14% in 1992 and all- time high (surplus) of 9.99% in 2005. Nigeria's real effective exchange rate (with base 2010 =100) averaged 110.67 from 1986 to 2019; it reached an all-time high of 275.29 index in 1998 and a record-low of 50.16 index in 1992. During the reported period, the official exchange rate of the naira to US dollar averaged ₦118.12; reached an all-time increase in 2019 and was exchanged at ₦307.00 per dollar, having reached a minimum exchange rate of ₦7.39 per US dollar in 1989.

Table 4.1: Descriptive Statistics of Variables

	BOPG	PSC	RER	RQ	RIR	OLP
Mean	-1.204613	11.85922	110.6709	37650.30	2.463872	46.09147
Median	-1.313303	8.353588	96.32105	30333.58	5.103890	28.63000
Maximum	9.990883	20.77330	275.2927	71387.83	18.18000	114.1500
Minimum	-11.14580	6.217349	50.16822	15237.99	-31.45257	12.77000
Std. Dev.	4.658351	5.493140	55.94490	20029.25	10.23609	33.18943
Skewness	0.537145	0.590429	1.824966	0.505049	-1.155160	0.824628
Kurtosis	3.401815	1.534003	5.497300	1.667673	4.913011	2.353228
Jarque-Bera	1.863701	5.020061	27.70789	3.960140	12.74602	4.446014
Probability	0.393824	0.081266	0.000001	0.138060	0.001707	0.108283
Observations	34	34	34	34	34	34

Source: Author's compilations based on Eviews 10.0 version.

Private sector credit (PSC) averaged 11.86% between 1986 and 2019. It rose from a minimum of 6.21% in 1995, to a maximum value of 20.77% in 2016. At the same time, real lending interest rate (RIR) which averaged 2.46% between 1986 and 2019, tumbled to an all-time low of -13.45% in 1995, and reached an all-time high in 2009 at 18.18%. Table 4.1 also shows that real output (RQ) which averaged ₦37650.30 billion from 1986 to 2019, increased from a minimum value of ₦15237.99 billion during theStructural Adjusment programme (SAP) year to all-time high of ₦71387.83 billion in 2019. During the study period, the price of Nigeria's Bonny Light oil averaged 46.09 US dollar per barrel, having increased from a minimum of 12.77 dollar per barrel in 1988 to a maximum of 114.15 dollar per barrel in 2011.

Apart from the associated measures of central tendency described above, the Jarque-Berra statistics indicates that the overall balance of payment, private sector credit, real output, and oil price were all normally distributed (probabilities greater than 0.05), except real exchange rate and real interest rate variables which are not normal (probabilities less than 0.05).

4.2. Results of unit root test

The stationnnarity test was carried out to confirm that all the study variables satisfied the ARDL underlying assumption of being I(0) or I(1), or both, but not I(2). The test results in levels and first differences based on Augmented Dickey–Fuller (ADF) procedure is presented in Table 4.2. The first column includes only an intercept, the second column includes an intercept and a trend, while the third column contains neither intercept nor trend in the estimating equation.

Table 4.2: Unit root tests result (Augmented Dickey–Fuller test)

Variables	Intercept	Intercept & trend	None	Order of integration
BOPG	-3.5167**	-3.8593**	-3.1556***	I(0)
ΔBOPG	-6.9566***	-6.8584***	-7.0616***	I(1)
Log(RER)	-2.7560*	-2.7549	-0.6457	I(1)
ΔLog(RER)	-6.0995***	-5.9111***	-6.2328***	I(1)
Log(RG)	-0.0968	-2.4033	2.5260	I(1)
ΔLog(RG)	-3.4341**	-3.3517*	-2.1580**	I(1)
PSC	-0.9245	-2.3652	0.5295	I(1)
ΔPSC	-5.0769***	-5.0202***	-4.9386***	I(1)
RIR	-7.2683***	-7.4756***	-7.1782***	I(0)
ΔRIR	-9.8216***	-9.5889***	-9.9892***	I(1)
Log(OLP)	-1.3077	-1.8250	0.7706	I(1)
ΔLog(OLP)	-4.9583***	-4.9508***	-4.7630***	I(1)

Note: Δ = first difference operator, p-values are in parentheses. *, **, *** represent the rejection of the null hypothesis at 10%, 5% and 1% level of significance, respectively.

The results indicate that while BOPG and RIR were stationary in levels, the remaining variables were stationary in first difference, thereby giving a mix of I(0) and I(1) variables in the sample. This affirmed the use of ARDL in the analysis. In applying the ARDL bounds model, we first obtained the optimal lag orders on the first differenced variable.As shown in Table 4.3, the maximum order of two (2) lags was selected for the ARDL estimation based on Akaike information criterion (AIC).

Table 4.3: Optimal lag length selection result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-942.7173	NA	2.27e+18	59.29483	59.56966	59.38593
1	-792.9455	234.0185	1.94e+15	52.18409	54.10787*	52.82177
2	-746.1765	55.53816*	1.28e+15*	51.51103*	55.08376	52.69529*

Note: * denotes lag-order selected by the criterion
LR denotes sequential modified LR test statistic; FPE denotes Final prediction error; AIC= Akaike information criterion; SC= Schwarz information criterion; and HQ: Hannan-Quinn information criterion.

The model selection criteria table for the first top 5 models based on Akaike information criterion is shown on Table 4.4. Among the selection criteria, the Akaike information criterion showed up with the minimum model specification of ARDL(1, 2, 2,0, 2, 1).

Table 4.4: Model Selection Criteria
Dependent Variable: BOPG

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
20	**-65.489100**	**4.968069**	**5.609328**	**5.180628**	**0.714817**	**ARDL(1, 2, 2, 0, 2, 1)**
11	-65.043750	5.002734	5.689798	5.230477	0.706330	ARDL(1, 2, 2, 1, 2, 1)
2	-64.261699	5.016356	5.749224	5.259281	0.702860	ARDL(1, 2, 2, 2, 2, 1)
19	-65.394469	5.024654	5.711718	5.252397	0.699822	ARDL(1, 2, 2, 0, 2, 2)
10	-64.961671	5.060104	5.792972	5.303029	0.689572	ARDL(1, 2, 2, 1, 2, 2)

4.4. Bounds test result
The results of bounds F-test with 5 regressors based on 34 observations are presented in Table 4.5.

Table 4.5: Results of the Bound Test based onARDL(1, 2, 2, 0, 2, 1)

Functional Form	F-statistic Value	k	Narayan's Critical Values Bound		
			Significance level (%)	1(0) Bound	1(I) Bound
BOPG = F(LOG(RER), LOG(RQ), PSC, RIR, LOG(OLP))	5.26	5	10	2.361	3.433
			5	2.826	4.049
			1	3.960	5.603

Source: Critical values for the bounds test from Narayan, P. K. (2004); Appendix A.

The calculated Fisherian statistic of the normalized equation is 5.26; and is greater than both the lower bound critical values and the upper bound critical values at both 10 and 5 per cent levels of significance. Hence, the null hypothesis of no long-run relationship was strongly rejected, meaning that there was long-run relationship among the variables used in the model. This implies that balance of payments, real exchange rate, private sector credit, real interest rate, and oil price all had equilibrium conditions that kept them together in the long-run. The confirmation of a cointegration relationship among the variables led to the estimation of the long-run and short-run coefficients based on the optimal ARDL model. The results are reported in Table 4.6.

Table 4.6: The long-run and short-run results of ARDL (1, 2, 2, 0, 2, 1)

Long-run estimates ***Dependent variable: BOPG***	**Coefficients**	**Standard errors**	**t-stats**	**Probabilities**
LOG(RER)	-1.0568	3.0546	-0.3460	0.7334
LOG(RQ)	22.3894***	7.3034	3.0656	0.0067
PSC	-0.8852**	0.4063	-2.1788	0.0429
RIR	-0.4403	0.3002	-1.4668	0.1597
LOG(OLP)	-4.8128	4.9333	-0.9756	0.3422
Constant	-203.4125***	63.2426	-3.2164	0.0048
Short-run results ***Dependent variable: ΔBOPG*** (Restricted Constant and No Trend)				
ΔLOG(RER)	0.0807	1.4268	0.0566	0.9555
ΔLOG(RER(-1))	-7.3677***	1.1901	-6.1909	0.0000
ΔLOG(RQ)	-15.6155	13.8281	-1.1293	0.2736
ΔLOG(RQ(-1))	57.0736***	12.9876	4.3945	0.0003
Δ(RIR)	0.0407	0.0393	1.0357	0.3141
Δ(RIR(-1))	0.1538***	0.0453	3.3928	0.0032
ΔLOG(OLP)	3.2829*	1.7628	1.8623	0.0790
CointEq(-1)*	-0.6389***	0.0912	-7.0066	0.0000

CointEq = BOPG - (-1.0568*LOG(RER) + 22.3894*LOG(RQ) - 0.8852*PSC - 0.4403*RIR - 4.8128*LOG(OLP) -203.4125)*

R-squared = 0.82 Adj R-squared = 0.76 D-W stat = 1.84; AIC = 4.59; SC = 4.96

Note: Δ = first difference operator. *, **, and *** denote 10%, 5% and 1% significant level, respectively.

4.5. Discussions of the results

The long-run result shows that apart from real output which was positively signed and statistically significant, real effective exchange rate (RER), private sector domestic credit (PSC), real interest rate (RIR), and oil price (OLP) had negative effects on overall balance of payments. Although the coefficient was statistically insignificant, the negative impact of real exchange rate however contradicted a priori expectation, and indicates that one percent decrease in real exchange rate would reduce balance of payments by 1.06%. This implies that exchange rate depreciation cannot be used to improve balance of payments position in Nigeria. The outcome, however, corroborates other studies (Umer *et al.*, 2010; Eita & Gaomab, 2012; Azra *et al.*, 2015; Osisanwo *et al*., 2019) where real exchange rate was found to be negative and insignificant in the long-run. The positive impact of real output implies increase in exports and favourable balance of payments, which agrees with the *a priori* expectation, and also consistent with those of Dhliwayo (1996), Adamu and Itsede (2010), Shafi, Hau, Idrees and Nazeer (2015). The estimated coefficient shows that 1% increase in real output improved Nigeria's balance of payments position by 22.4%.

The coefficient of private sector domestic credit showed a significant negative relationship with the balance of payments, and is not in conformity with a priori expectation. The negative impact suggests that Nigeria is a net importer, and any available credit would increase the demand and expenditure on imported goods, which would in turn, reduce the net foreign assets, and hence balance of payments. This finding corroborates Adamu and Itsede (2010) for West African Monetary Zone, Nuwagira and Nizeyimana (2017) for Rwanda, and Akpansung (1998) for Nigeria. Although the real interest rate coefficient appeared with the right sign (negative) in the long-run, in consonance with the theoretical expectation., it was statistically insignificant. Similar results were obtained by Dhliwayo (1996), Umer *et al.* (2010). This finding is however contrary to Eita and Gaomab (2012) which found interest rates positively linked to the balance of payments in Namibia.

On the other hand, the Nigeria's Bonny Light oil price indicated a non-statistically significant negative relationship with the aggregate balance of payments in the long-run. This result was inconsistent with the a priori expectations, but accords with Sakanko *et al.* (2019) which found negative relationship between oil price volatility and balance of payments in Nigeria between 1980 and 2017.

The short-run estimates showed that changes in lagged values of the real exchange rates, real GDP, and real interest rate impacted significantly on the balance of payments. Real exchange rate changes influenced external balance negatively, while real GDP and real interest rate impacted positively. Although the negative coefficient of the real exchange rate was not in conformity with a priori expectation, it tallied with Jayasooriya (2020) which found that real effective exchange rate was negatively significant in the short-run in South Asia. The coefficient of oil price appeared positively significant at 10% level; the signed outcome aligned with economic theory and the empirical finding of Broni-Bediako, Onyije and Unwene (2018) which indicated that Nigeria's balance of payments responded directly to fluctuations in the price of crude oil.

As Table 4.6 further shows, the coefficient of the error correction term (ECT) was statistically significant, with the expected negative sign. The coefficient showed a high rate of convergence to equilibrium, and suggested that about 63.9% of the disequilibrium in the previous year was corrected in the current year. The adjustment was achieved within 1 year, and 6 months. The coefficient of determination was good; about 82.0% of the variations in the balance of payments position in Nigeria was accounted for by the explanatory variables included in the study, while the remaining 18% variation were explained by other variables not captured by the model, which was represented by the error term.

4.6. Diagnostic Analysis

The estimated ARDL (1, 2, 2, 0, 2, 1) error correction model was tested for normality, heteroscedasticity, serial correlation, functional form misspecification, and parameter stability. The Jarque–Bera test result indicates that the errors were normally distributed. There was no serial correlation in the series. The model also appeared not be heteroscedastic, while the RESET result suggested that the model was correctly specified. The p-values of the respective test staistics were higher than the 0.05 percent level of significance (See Table 4.7).

Table 4.7: Residual/ Stability diagnostic checks

Tests	Null hypotheses	Test statistic	Prob. value	Conclusion
Jarque–Bera normal distribution	Residuals are normally distributed	0.559	0.756	Do not reject Ho
Breusch-Godfrey LM (2)	No serial correlation	1.275	0.306	Do not reject Ho
Breusch–Pagan–Godfrey	No heteroscedasticity	1.418	0.242	Do not reject Ho
Ramsey RESET	The model is correctly specified	0.008	0.930	Do not reject Ho
CUSUM /CUSUMSQ	The model is structurally stable	na	na	Do not reject Ho

Source: Author's calculations. LM is the Lagrangian multiplier with the number of lags in parenthesis.

The study equally confirmed the structural stability of the model using both the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squared recursive residuals (CUSUMSQ) tests. The blue lines in both the CUSUM and CUSUMSQ plots dwelled within the critical bounds at the 5% level of significance (See Figure 4.1).

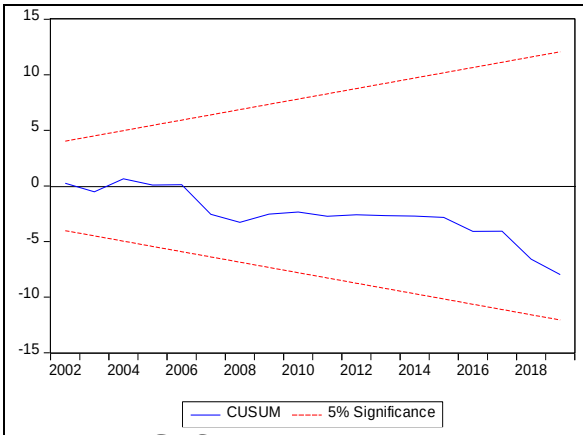

Fig. 4.1a: CUSUM Test

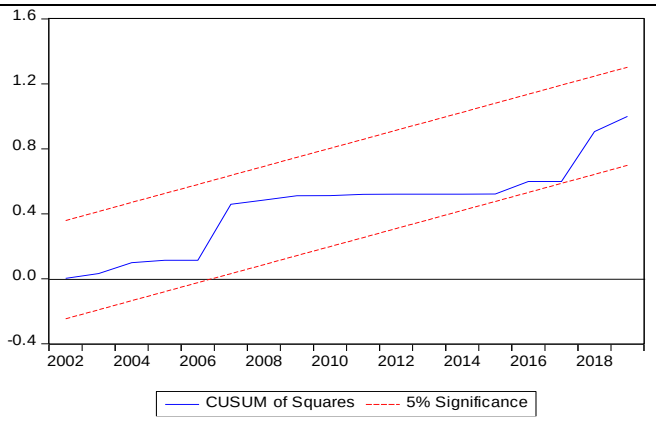

Fig. 4.1b: CUSUMSQ Test

5. Conclusions, Policy Implications and Recommendations

This study empirically examined the impact of real exchange rate on Nigeria's overall balance of payments for the period spanning 1986 -2019. Real output, real interest rate, private sector credit, and oil prices were included in the model to make the study empirically robust. The autoregressive distributed lag (ARDL) methodology was employed to analyse the data based on the outcome of the stationarity test. The empirical evidences in this study led to the conclusion that real effective exchange rate variations or depreciations only can not be used to improve balance of payments position in Nigeria.. Real exchange rate affected the overall balance of payments negatively in the long-run and in the short-run with a lag; the long-run impact was statistically insignificant and the magnitude of the long-run coefficient exceeded its negatively significant lagged short-run value.

There are some policy implications associated with the findings. First, the negative effect of real exchange rate on overall balance of payments both in the long-run and short-run, implies that foreign exchange rate management policies in Nigeria were not effective to achieve external balance, and therefore calls for the need to design and implement foreign exchange policies from both the long-run and short-run perspectives. Second, the negative impact of private sector domestic credit on the balance of payments implies high import dependence, and increased spending on imported goods, and further deterioration of external balance. Third, the significant positive impact of lagged interest rate on balance of payments signifies the cumulative effects of interest rate, and suggests, however, that interest rate can be used as a policy tool to ensure favourable capital accounts and improved overall balance of payments. Fourthly, the negative effect of the oil price on Nigeria's balance of payments in the long-run signifies the need to diversify the country's export basket to ensure enhanced participation of non-oil products Finally, it is apparent that any external stabilization programme which relies profoundly on real exchange rate adjustment alone may have little success in improving the overall balance of payments if it is not accompanied by consistent and prudent monetary and fiscal policies that would affect real output, private sector credit, and real interest rate.

On the basis of the findings, this paper recommended; i) Encouraging private investments and production of quality exportable goods to help reduce balance of payments deficits in the country. ii). Strong enforcement of existing regulations (by the monetary authority) to promote the use of the naira in order to combat currency shortages on the foreign exchange market and ensure stable exchange rate. iii). Use of contractionary monetary policy measures to reduce private sector credit or close monitoring of the loans extended to the private sector to ensure productive utilization of the credit facilities, iv). Implementation of structural policies that would help diversify the economy in order to withstand the recurring oil price and other commodity price shocks.

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